

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (currently amended) An illumination apparatus for illuminating a surface to be illuminated with a radiation, comprising:

a radiation source;

a zoom optical system;

an optical integrator; and

a radiation beam adjustor which is arranged in an optical path between the radiation source and the optical integrator;

wherein the radiation beam adjustor generates at least a continuously variable multipole radiation distribution in an illumination pupil, and includes a plurality of optical surfaces which are arranged in an array and substantially in a plane,

wherein the plurality of optical surfaces deflect a radiation beam from the radiation source to plural directions,

wherein one of the deflected radiation beams reaches one of the multipole, and another one of the deflected radiation beams reaches another one of the multipole, and
~~wherein the multipole radiation distribution can be continuously varied.~~

2. (original) The illumination apparatus according to claim 1, wherein the radiation beam adjustor is arranged in an optical path between the radiation source and the zoom optical system.

Claims 3 and 4 (cancelled).

5. (previously presented) The illumination apparatus according to claim 1, wherein the plurality of optical surfaces include a refractive surface.

6. (original) The illumination apparatus according to claim 1, wherein the radiation beam adjustor includes a diffuser.

Claim 7 (Cancelled)

8. (original) The illumination apparatus according to claim 1, further comprising a polarization reliever.

9. (original) The illumination apparatus according to claim 8, wherein the polarization reliever includes an optical member made of quartz.

10. (original) The illumination apparatus according to claim 9, wherein the optical member made of quartz includes a quartz prism.

11. (original) The illumination apparatus according to claim 8, wherein the polarization reliever is arranged in an optical path between the radiation source and the radiation beam adjustor.

12. (original) The illumination apparatus according to claim 1, wherein the radiation beam adjustor includes a refractive element.

13. (original) The illumination apparatus according to claim 1, wherein the multipole radiation distribution includes dipole, quadrupole, or octpole.

14. (original) The illumination apparatus according to claim 1, wherein the multipole radiation distribution includes a multipole with on-axis pole.

15. (original) The illumination apparatus according to claim 1, wherein the radiation beam adjustor generates an annular radiation distribution.

16. (original) The illumination apparatus according to claim 15, wherein the radiation beam adjustor includes a first element which is arranged in an illumination optical path when the multipole radiation distribution is generated, and a second element which is arranged in the illumination optical path when the annular radiation distribution is generated.

17. (original) The illumination apparatus according to claim 1, wherein the zoom optical system changes the multipole radiation distribution continuously.

18. (original) The illumination apparatus according to claim 1, wherein the radiation beam adjustor generates a radiation distribution for a conventional illumination.

19. (original) The illumination apparatus according to claim 18, wherein the radiation beam adjustor includes a first element which is arranged in an illumination optical path when the multipole radiation distribution is generated, and a second element which is arranged in the illumination optical path when the radiation distribution for the conventional illumination is generated.

20. (original) A projection exposure apparatus for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising:

the illumination apparatus according to claim 1 which illuminates the mask,

wherein the illumination pupil of the illumination apparatus is conjugate with a pupil of the projection optical system.

21. (original) A projection exposure method for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising the steps of:

illuminating the mask with the illumination apparatus according to claim 1; and

projecting the pattern on the mask onto a workpiece.

22. (currently amended) An illumination apparatus for illuminating a surface to be illuminated with a radiation, comprising:

a radiation source;

an adjusting optics including a plurality of optical elements; and

an optical integrator,

wherein the adjusting optics controls an inner and/or outer radial extent of an illumination distribution on an illumination pupil,

wherein the plurality of optical elements ~~can~~are arranged to be inserted in an illumination optical path,

wherein each of the plurality of optical elements defines at least one parameter of the illumination distribution on the illumination pupil, ~~and~~

~~wherein at least two of the plurality of optical elements can be~~the plurality of optical elements have a first set of optical elements and a second set of optical elements, and

wherein one of the first set of optical elements and one of the second set of optical elements are arranged at approximately a same place in the illumination optical path simultaneously.

23. (original) The illumination apparatus according to claim 22, wherein the plurality of optical elements include a refractive element.

24. (original) The illumination apparatus according to claim 22, wherein the adjusting optics forms a multipole illumination distribution and/or an annular illumination distribution in the illumination pupil.

25. (original) The illumination apparatus according to claim 24, wherein the adjusting optics includes a zoom optical system.

26. (original) The illumination apparatus according to claim 24, wherein the plurality of optical elements include a plurality of optical surfaces which are arranged in an array.

27. (original) A projection exposure apparatus for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising:

the illumination apparatus according to claim 22 which illuminates the mask,

wherein the illumination pupil of the illumination apparatus is conjugate with a pupil of the projection optical system.

28. (original) A projection exposure method for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising the steps of:

illuminating the mask with the illumination apparatus according to claim 22; and

projecting the pattern on the mask onto a workpiece.

29. (currently amended) An illumination apparatus for illuminating a surface to be illuminated with a radiation, comprising:

a radiation source;

an optical integrator; and

an adjusting optics which is arranged in an optical path between the radiation source and the optical integrator, which includes a plurality of optical elements,

wherein the adjusting optics controls an inner and/or outer radial extent of an illumination distribution on an illumination pupil,

wherein the plurality of optical elements ~~can~~are arranged to be inserted in an illumination optical path,

wherein each of the plurality of optical elements defines at least one parameter of the illumination distribution on the illumination pupil, and

wherein the adjusting optics excludes an axicon and forms a multipole illumination distribution and/or an annular illumination distribution in the illumination pupil.

30. (original) The illumination apparatus according to claim 29, wherein the plurality of optical elements include a refractive element.

Claim 31 (canceled)

32. (previously presented) The illumination apparatus according to claim 29, wherein the adjusting optics includes a zoom optical system.

33. (previously presented) The illumination apparatus according to claim 29, wherein the plurality of optical elements include a plurality of optical surfaces which are arranged in an array.

34. (original) A projection exposure apparatus for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising:

the illumination apparatus according to claim 29 which illuminates the mask,

wherein the illumination pupil of the illumination apparatus is conjugate with a pupil of the projection optical system.

35. (original) A projection exposure method for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising the steps of:

illuminating the mask with the illumination apparatus according to claim 29; and

projecting the pattern on the mask onto a workpiece.

36. (currently amended) An illumination apparatus for illuminating a surface to be illuminated with a radiation, comprising:

a radiation source;

a first member with a plurality of elements arranged in an array; and

a second member with a plurality of elements arranged in an array,

wherein the plurality of elements of the first and the second member are each assigned to radiation channels, and the plurality of elements are configured or arranged such that a continuous beam path from the radiation source to the surface to be illuminated results for each radiation channel,

wherein the assignment ~~can be manipulated~~ is manipulatable such that, by assigning the plurality of elements of the first to the second member, a predetermined illumination is adjusted in an illumination pupil of the illumination apparatus,

wherein the second member comprises such a number of elements that at least two predetermined illuminations ~~can be~~ are adjusted by changing the assignment of the plurality of elements of the first member to the plurality of elements

of the second member, without having to replace the second member,

and wherein the first member with the plurality of elements ~~can be exchanged~~ is replaceable and by replacing the first member it is possible to achieve a different assignment of the plurality of elements of the first member to the plurality of elements of the second member and thereby a different illumination in the illumination pupil.

Claims 37 and 38 (canceled).

39. (previously presented) The illumination apparatus according to claim 36, further comprising a holder which holds a plurality of the first members, wherein the first members can be replaced by operation of the holder.

40. (original) The illumination apparatus according to claim 36, wherein the first member is arranged in an optical path between the radiation source and the second member.

41. (previously presented) The illumination apparatus according to claim 36, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are configured such that the illumination in the illumination pupil is annular-shaped.

42. (previously presented) The illumination apparatus according to claim 36, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are configured such that the illumination in the illumination pupil is multipole-shaped.

43. (previously presented) The illumination apparatus according to claim 36, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are configured such that the illumination in the illumination pupil is an illumination for a conventional illumination.

44. (original) A projection exposure apparatus for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising:

the illumination apparatus according to claim 36 which illuminates the mask,

wherein the illumination pupil of the illumination apparatus is conjugate with a pupil of the projection optical system.

45. (original) A projection exposure method for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising the steps of:

illuminating the mask with the illumination apparatus according to claim 36; and

projecting the pattern on the mask onto a workpiece.

46. (currently amended) An illumination apparatus for illuminating a surface to be illuminated with a radiation, comprising:

a radiation source;

a first member with a plurality of elements arranged in an array;

a second member with a plurality of elements arranged in an array,

wherein the plurality of elements of the first and the second member are each assigned to radiation channels, and the plurality of elements are configured or arranged such that a continuous beam path from the radiation source to the surface to be illuminated results for each radiation channel, and

the second member with the plurality of elements ~~can be exchanged~~is replaceable and at least one particular illumination in an illumination pupil ~~can be~~is achieved with each second member, so that by replacing ~~the~~a second member, a different assignment of the plurality of elements of the first member with the plurality of elements of the second member is realized.

47. (original) The illumination apparatus according to claim 46, wherein the first member is exchangeable.

48. (previously presented) The illumination apparatus according to claim 46, wherein the plurality of elements of the first member are imaged in the surface to be illuminated and the radiation channels are superimposed on each other in the surface to be illuminated.

49. (original) The illumination apparatus according to claim 46, wherein the plurality of elements of the first member produce secondary radiation sources near the plurality of elements of the second member.

50. (original) The illumination apparatus according to claim 49, further comprising an optical system which is arranged in an optical path between the second member and the surface to be illuminated and which images the secondary radiation sources to the illumination pupil.

51. (previously presented) The illumination apparatus according to claim 46, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are configured such that the illumination in the illumination pupil is annular-shaped.

52. (previously presented) The illumination apparatus according to claim 46, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are

configured such that the illumination in the illumination pupil is multipole-shaped.

53. (previously presented) The illumination apparatus according to claim 46, wherein the radiation channels between the first member with the plurality of elements and the second member with the plurality of elements are configured such that the illumination in the illumination pupil is an illumination for conventional illumination.

54. (original) A projection exposure apparatus for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising:

the illumination apparatus according to claim 46 which illuminates the mask,

wherein the illumination pupil of the illumination apparatus is conjugate with a pupil of the projection optical system.

55. (original) A projection exposure method for projecting a pattern on a mask onto a workpiece through a projection optical system, comprising the steps of:

illuminating the mask with the illumination apparatus according to claim 46; and

projecting the pattern on the mask onto a workpiece.